KEY

UNIT 16 – NUCLEAR CHEMISTRY

HALF-LIFE PROBLEMS WORKSHEET

1.) What is the half-life of a 100.0 g sample of nitrogen-16 that decays to 12.5 grams in 21.6 seconds?

$\frac{100}{2} = \frac{50}{2} = \frac{25}{2} = 12.5$ → 3 HALF LIVES

$3\overline{)21.6}$ → **7.2 s**

2.) All isotopes of technetium are radioactive, but they have widely varying half-lives. If an 800.0 gram sample of technetium-99 decays to 100.0 g of technetium-99 in 639,000 years, what is its half-life?

$\frac{100.0\text{ g}}{800.0\text{ g}} = \frac{1}{8}$ = 3 HALF LIVES

$3\overline{)639,000}$

213,000 YEARS

3.) A 208 g sample of sodium-24 decays to 13.0 g of sodium-24 within 60.0 hours. What is the half-life of this radioactive isotope?

$\frac{13.0\text{ g}}{208\text{ g}} = \frac{1}{16}$ → 4 HALF LIVES

$4\overline{)60.0}$

15.0 hrs

4.) If the half-life of iodine-131 is 8.10 days, how long will it take a 50.00 g sample to decay to 6.25 g?

$\frac{50.0}{2} = \frac{25}{2} = \frac{12.5}{2} = 6.25$

1 2 3

8.10 days × 3 =

24.3 days

5.) The half-life of hafnium-156 is 0.025 seconds. How long will it take a 560 g sample to decay to one-fourth of its original mass?

$\frac{1}{4}$ → 2 HALF LIVES

0.025×2

0.05 SECONDS

6.) Chromium-48 has a short half-life of 21.6 hours. How long will it take 360.00 g of chromium-48 to decay to 11.25 g?

$\frac{360}{2} = \frac{180}{2} = \frac{90}{2} = \frac{45}{2} = \frac{22.5}{2} = 11.25$

1 2 3 4 5

HALF LIVES

21.6 HRS × 5

= 108 HRS

7.) Potassium-42 has a half-life of 12.4 hours. How much of an 848 g sample of potassium-42 will be left after 62.0 hours?

5 HALF LIVES

$12.4\overline{)62.0}$ → 5

OR → $\frac{848}{2} = \frac{424}{2} = \frac{212}{2} = \frac{106}{2} = \frac{53}{2} =$ **26.5 g**

1 2 3 4 5

$32\overline{)848}$ → OR

8.) Carbon-14 has a half-life of 5730 years. How much of a 144 g sample of carbon-14 will remain after 1.719×10^4 years?

$5,730\overline{)17,190\text{ YRS}}$ → 3

$\frac{144}{2} = \frac{72}{2} = \frac{36}{2} =$ **18 g**

1 2 3

OR $\sqrt[3]{144}$

9.) If the half-life of uranium-235 is 7.04×10^8 years and 12.5 g of uranium-235 remain after 2.82×10^9 years, how much of the radioactive isotope was in the original sample?

704,000,000

2,820,000,000

$7.04 \times 10^8\overline{)2.82 \times 10^9}$ → 4

$\frac{12.5}{2} = \frac{6.25}{2} = \frac{3.125}{2} = \frac{1.56}{2} =$ **0.78 g**

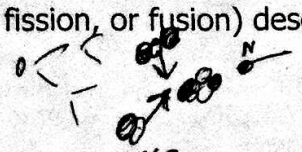
1 2 3 4

OR $16\overline{)12.5}$

UNIT 16 – NUCLEAR CHEMISTRY

BALANCING NUCLEAR REACTIONS WORKSHEET

Predict the missing product or reactant in the following nuclear reactions. Determine the type of nuclear reaction (α emission, β emission, γ emission, positron emission, artificial transmutation, fission, or fusion) described. $^{0}_{0}\gamma$ $^{0}_{1}e$



		Type of Nuclear Reaction
1.)	$^{42}_{19}K \rightarrow {}^{0}_{-1}e + {}^{42}_{20}Ca$	1.) BETA
2.)	$^{239}_{94}Pu \rightarrow {}^{4}_{2}He + {}^{235}_{92}U$	2.) ALPHA
3.)	$^{235}_{92}U \rightarrow {}^{4}_{2}He + {}^{231}_{90}Th$	3.) ALPHA
4.)	$^{1}_{1}H + {}^{3}_{1}H \rightarrow {}^{4}_{2}He$	4.) FUSION (H ATOMS)
5.)	$^{6}_{3}Li + {}^{1}_{0}n \rightarrow {}^{4}_{2}He + {}^{3}_{1}H$	5.) ---
6.)	$^{27}_{13}Al + {}^{4}_{2}He \rightarrow {}^{30}_{15}P + {}^{1}_{0}n$	6.) [illegible]
7.)	$^{9}_{4}Be + {}^{1}_{1}H \rightarrow {}^{6}_{3}Li + {}^{4}_{2}He$	7.) ALPHA
8.)	$^{37}_{19}K \rightarrow {}^{0}_{+1}e + {}^{37}_{18}Ar$	8.) POSITRON EMISSION
9.)	$^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{142}_{56}Ba + {}^{91}_{36}Kr + 3\,{}^{1}_{0}n$	9.) FISSION
10.)	$^{238}_{92}U + {}^{4}_{2}He \rightarrow {}^{241}_{94}Pu + {}^{1}_{0}n$	10.) ART. TRANS.
11.)	$^{14}_{6}C \rightarrow {}^{14}_{7}N + {}^{0}_{-1}e$	11.) BETA
12.)	$^{187}_{75}Re + {}^{2}_{1}H \rightarrow {}^{188}_{75}Re + {}^{1}_{1}H$	12.) ---
13.)	$^{22}_{11}Na + {}^{0}_{-1}e \rightarrow {}^{22}_{10}Ne$	13.) ---
14.)	$^{218}_{84}Po \rightarrow {}^{214}_{82}Pb + {}^{4}_{2}He$	14.) ALPHA
15.)	$^{253}_{99}Es + {}^{4}_{2}He \rightarrow {}^{1}_{0}n + {}^{256}_{101}Md$	15.) FISSION